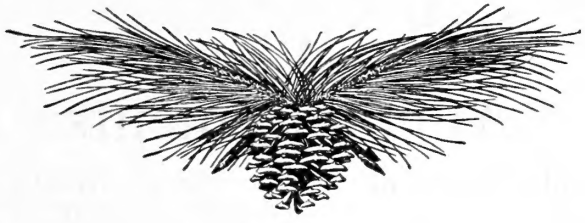
FOREST WORKER



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Announcements

Fifth International Congress of Entomology

The Fifth International Congress of Entomology will be held in Paris, July 16 to 23, inclusive, 1932. In conjunction with this meeting there will be a celebration of the centenary of the Société Entomologique de France. P. Marchal is president of the congress, and R. Jeannel is secretary general. Doctor Jeannel's address is Museum National d'Histoire Naturelle, 45 bis, Rue de Buffon, Paris (5).

American Forestry Association to Meet in Baltimore

The annual meeting of the American Forestry Association will be held in Baltimore, Md., May 26–27, 1932, under the auspices of State Forester Besley and the Maryland Forestry Association. The central theme of the program is "Forests and forestry in relation to water conservation." There will be three sessions of discussion and one half-day field trip.

First International Recreation Congress

The National Recreation Association has announced that the First International Recreation Congress will be held in Los Angeles, Calif., July 23 to 29, 1932, one week before the Olympic Games. On March 7 the association had already been assured that 27 nations would send delegates.

The National Conference on State Parks will hold its annual meeting of 1932 at Virginia Beach, Va., May 4–7.

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FOREST WORKER

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State Forestry

Wisconsin Will Spend $500,000 of Relief Fund on Forest Protection

The Wisconsin Conservation Commission's share of the State's emergency relief appropriation was $500,000. The commission announced that it would begin at once to spend this money by employing men for forest-protection work. A part of the money would necessarily be spent for hand tools, but none of it would go into the purchase of major equipment. The leading project in the program of work decided upon is developing fire roads to inaccessible areas, a purpose for which hundreds of miles of abandoned logging grades are available in Wisconsin's forest areas. Other work will include constructing firebreaks, telephone lines, ranger headquarters, substations, lookouts, and warehouses, and suppressing fire.

Eligibility for employment is conditioned on six months' residence in the State, and preference is given to local residents with dependents. The widest possible distribution of relief will be sought.

Economical Method of Burning Rights of Way

District Wardens Weaver, of New Milford, Conn., and Kugeman, of Cornwall, Conn., hope to save time and money in burning railroad rights of way this spring by following a method which they tried out in 1931 with the cooperation of Supervisor Cronin, Housatonic Division, New York, New Haven & Hartford Railroad.

Wherever the railroad runs at the base of a steep slope of either brush or grass land, permission is asked of the property owner to burn a strip at least 100 feet or 150 feet wide. When permission is given the men clear a path at least 3 feet wide on the outside limit agreed upon. A strip of sod about 1½ feet wide is cut with mattocks and is turned over downhill. Then a man with a torch starts the fire in a line parallel with this path and about 5 feet downhill from it. Men with pumps, brooms, and shovels watch closely to see that no fire gets across the path. As soon as this line is safe a new line is started 50 feet down the hill. When the second fire meets the upper fire it is safe to start the fire at the track.

The sod can be cut at times when it is not feasible to start burning—early in the morning, during the last hour of the working day, or on cloudy days. The second year, raking the leaves off the path makes it ready for use again.

Wardens Kugeman and Weaver found that a crew of from 12 to 15 men is about the right size for this work.

Virginia Commission Recommends That Forest-Protection System be Expanded

Substantial increases in Virginia's appropriations for forest fire protection are urged in the report presented this year by the commission appointed to study the forestry conditions of Virginia under provisions of an act of the State legislature approved March 24, 1930. At present, organized forest fire protection is lacking in 42 counties of Virginia. The commission's recommendation of increased appropriations for fire protection is prefaced with this statement: "The commission can not too strongly express the present need of sufficient funds to permit the organization of the entire 100 counties for forest fire protection. The need is so great that it amounts to an emergency."

As a fire-preventive measure the commission recommends enactment of a state-wide "no fence" law, that is, a law relieving landowners of the responsibility of fencing their land to exclude livestock running at large. Considerable evidence presented before the commission tended to prove that in certain parts of the State not covered by "no fence" laws fires are repeatedly set on land by persons other than the owners with the intention to have their livestock graze on the land and in the belief that fire will improve the grazing. The commission recommends enactment of a statute declaring that any person, firm, or corporation responsible, through wilfulness or negligence, for the origin of a forest fire shall be liable for all costs incurred by the State, the county, or both State and county in suppressing the fire.

In the opinion of the commission Virginia should proceed as soon as possible to establish four or five demonstration forests in different parts of the State, with a maximum area of 10,000 acres each. This would be mainly an educational measure. It is

recommended also that laws be enacted providing for the establishment of a small forestry demonstration plot at or near every country and small-town public school in the State.

Under certain conditions the commission favors free distribution of forest tree seedlings produced at the State forest nursery.

The act creating the commission charged it to make a careful study of different methods of taxing forests and waste lands in other States and attempt to ascertain what methods of taxation of forests and waste lands in Virginia would have the most favorable effect upon the agricultural and industrial welfare and prosperity of the State. Having made such a study the commission recommends that legislation in Virginia looking toward any far-reaching change in the method of taxing forests and waste lands be deferred until the Forest Taxation Inquiry of the United States Forest Service has published its final report.

C. H. Morrissett, State tax commissioner, was chairman of the commission. The other members were Paul Ryland Camp, of Southampton; R. H. Langhorne, State senator, of Campbell; W. Stuart Moffett, assemblyman, of Augusta; and Jaquelin P. Taylor, of Orange and Richmond.

Survival High in Hawaiian Plantations

Reports on plantings made on Hawaiian forest reserves which were compiled in 1931 by the Territorial forester showed that of 150,555 trees planted during the preceding 10 years 88 per cent were alive and growing thriftily. The trees were of 44 different species and had been planted on various sites and in various spacings. Plantings of cajeput-tree, white ash, and silky oak made in the preceding two years, constituting 46 per cent of all the trees planted on the forest reserves during that period, had been 93 per cent successful.

During the year ending June 30, 1931, almost 28,000 trees per month were planted on the Hawaiian forest reserves, which at the end of that year had a total area of 1,021,314 acres.

Maryland Fires of 1931

Forest fires in Maryland in 1931 numbered 1,086 and covered 28,525 acres of land, the State department of forestry reports. This acreage amounts to 1.3 per cent of the State's forest area. The average acreage per fire was 27, which is smaller than that recorded for any year of the past decade except 1927. Two fires, occurring in Washington and Allegheny Counties, covered more than 1,000 acres each, and 58 fires covered more than 100 acres each. Most of the large fires occurred in the middle of April. The fires were classified according to cause as follows: Smokers, 431; brush burning, 279; incendiary, 167; railroads, 88; campers, 29; lumbering, 4; lightning, 2; miscellaneous, 83; unknown, 3.

California Maintains 2,000 Men in Forest Labor Camps

California's current appropriation for firebreak construction recently became $110,000 when the governor allotted to this purpose $100,000 of the State emergency fund. The money is being used largely to maintain unemployed men in forest labor camps, principally for the purpose of constructing firebreaks at the lower edge of the coniferous timber belt in northern California and in strategic locations for the control of fire in southern California brush fields. At the end of January 2,000 men were enrolled in such camps. The men work from five to six hours a day, without wages. They are provided with food and essential articles of clothing at State expense. Certain other costs including those for medical care and tobacco are met by counties, cities, and private agencies. The camps and the work are supervised by State and Federal forest rangers.

Society for Protection of New Hampshire Forests Acquires Additional Areas

Twenty-six strips of forested land along New Hampshire highways became public property in 1931, and three more in January and February of 1932, reports Philip W. Ayres, forester of the Society for Protection of New Hampshire Forests. In cooperation with the New England Council and the New Hampshire State Federation of Women's Clubs this society has been working for years to perpetuate roadside beauty by having timberlands bordering roadsides brought into State or town ownership or by acquiring them itself. These new acquisitions, most of which were gifts, raise the total number of such reservations to 102. Forest reservations now border about 35 miles of highway in New Hampshire. Some of them are 165 feet wide, which is about as far as the highway traveler can see into the woods in winter. Others are 125 feet wide, or as far as he can usually see in summer. A few include only the timber growing within the limits of the highway.

Under the auspices of the Society for Protection of New Hampshire Forests 15,000 trees were planted in school yards and 15,000 along highways last year in commemoration of the George Washington Bicentennial. The campaign for planting bicentennial trees is being continued this year. The State forestry department provides the trees, and landscape architects of Dartmouth College and the State university are assisting.

The society is seeking to acquire 1,600 additional acres on Mount Kearsarge, where by joint action with the New Hampshire Forestry Department it acquired 1,350 acres some years ago. The purchase price is $5 an acre, and the option expires September 1, 1932. The society is now at work on improvements in

Franconia Notch, where 6,000 acres became public property four years ago. It is planned to build two one-way roads through the notch, one on either side of the Pemigewasset River. In 1931 the notch is believed to have had 1,000,000 visitors.

From June 20 to July 2, 1932, the society will hold a nature school at its Lost River Reservation. L. M. Gould, who was geologist with the Byrd South Polar Expedition, will conduct some of the classes in field geology.

Connecticut Plan for Bicentennial Planting

The Connecticut Forest and Park Association, in cooperation with the Connecticut State Highway Department, has made an offer to individuals, clubs, and associations that simplifies participation in the planting of a mile of roadside shade trees to commemorate the George Washington Bicentennial. The association has offered to plant one or more trees at the rate of $5 per tree, identifying each tree for the donor and for its own records by attaching to it a small numbered metal disk. The bureau of roadside development of the State highway department has assumed responsibility for choosing suitable tree species and supervising the plantings, and will replace any trees failing to survive the first year.

The Georgia Commission of Forestry and Geological Development has done away with the offices of assistant State foresters and divided the State into eight districts with a district forester in charge of each. Headquarters and district foresters of districts 1 to 8 are as follows: 1, Rome, W. D. Young; 2, Gainesville, Everett B. Stone, jr.; 3, Augusta, Charles N. Elliott; 4, Columbus, W. G. Wallace; 5, Macon, H. M. Sebring; 6, Savannah, Jack Thurmond; 7, Waycross, C. Bernard Beale; 8, Albany, H. D. Story, jr.

Georgia to Operate Two Tree Nurseries

An 11-acre tract of land on the Dougherty County farm, near Albany, Ga., has been selected as the site for a tree nursery to be operated by the Georgia Division of Forestry. The site is on the Albany-Newton highway. Dougherty County and the city of Albany are cooperating with the division of forestry in providing not only land but water.

This nursery will be devoted largely to growing planting stock of slash and longleaf pines, which are native to that part of the State and are in great demand. H. D. Story, jr., the local district forester, is to have charge. He expects to have about 1,750,000 slash, longleaf, and loblolly pine seedlings ready for distribution in the fall of 1932.

A site for a second State tree nursery has been chosen on the grounds of the Georgia Experiment Station's mountain branch, in Union County near Blairsville. The area selected is on the Appalachian Scenic Highway. State Forester Lufburrow announces that this nursery will be used to grow trees indigenous to the mountains, such as black locust, northern white pine, hemlock, spruce, and shortleaf pine, also black walnut, yellow poplar, and other species of trees suited to the upper part of the State. Loblolly pine, Japanese chestnut, and other species will be grown experimentally.

Acting upon recommendations of the New Jersey Department of Conservation, the city of Newark, N. J., has instituted forestry management on its municipal watershed of approximately 35,000 acres located in Passaic, Sussex, and Morris Counties. John M. Heilman, a graduate of the Pennsylvania State Forest School and of Yale University, has resigned from the State forestry organization to take charge of forestry work on the Newark watershed area.

Education and Extension

Farms in Palermo, N. Y., Largely Meet Their Own Timber Requirements

A survey of 34 farms in the town of Palermo, Oswego County, N. Y., made in the fall of 1931 by Extension Forester J. A. Cope and County Agent H. L. Page, showed that wood is used as fuel on every one of the farms. On 19 farms wood is the only fuel burned. The quantity of fuel wood consumed on the 34 farms in the course of a year totaled 1,310 face cords. (This wood averaged 15 inches in length.) Thirteen farm owners having some timbered upland are cutting their fuel wood selectively, 14 whose woodlands are chiefly swamp land are cutting clear, and 3 owners cut dead and down timber exclusively.

All but two of the farms have woodlands. Woodland area averages about 30 acres per farm, the size of the farms averaging about 130 acres.

Twenty-three of the woodland owners obtain their fence posts chiefly from their own woods, using northern white cedar, chestnut, black cherry, and hemlock for this purpose. The remainder buy all their fence posts because they have no timber of suitable species. Home-produced lumber only was used on 17 of the 28 farms on which lumber was reported to be used annually, and supplied part of the lumber needs of 2 others. The home-grown lumber used annually averaged 1,870 board feet per farm.

Forest products sold from 12 farms in the last 10 years had a total value of about $18,485, or $154 per

farm per year. Fuel wood sold during that period from these farms brought in about $12,200. (These figures cover some labor.)

Grazing is permitted on the woodlands of 24 farms.

The farms covered by this study are within convenient hauling distance (5 miles or less) of two permanent mills that do custom sawing at a reasonable charge. The town of Fulton is near enough to provide a limited market, at a fair price, for fuel wood. Plants in the vicinity offer a market for hardwood logs to be used for basket veneers and pine logs to be used for crate stock.

Farmers Make Direct Sales of Pulpwood

North Carolina farmers are receiving help from Extension Forester Graeber in marketing small timber cut as thinnings without the intervention of a middleman. Mr. Graeber has circulated questionnaires to veneer mills, furniture manufacturers, manufacturers of lumber, and pulp and paper mills, and as a result has been enabled to circulate to farmers a list of mills to which they may sell direct, showing the kind of wood purchased by each mill. He has also arranged a cooperative contract with a large pulp mill for the sale of 1,000 cords of pine, poplar, and gum wood. Through this arrangement 36 farmers in eight counties have sold from one to eight carloads of pulpwood each direct to the mills, at a price of $7 per cord.

Farmers' social clubs organized some years ago in Halifax County, Va., are handling a trial order for 1,000 cords of pulpwood, arrangements for which were made by County Agent Hall directly with the Bedford Pulp & Paper Co. The order is for 160-foot cords of peeled pine, with a minimum diameter of 4 inches. The clubs are confining this business to farmers who agree to cut the wood as thinnings and weedings.

"Many of the 250,000 trees planted in the 1929–30 tree-planting campaign in Custer County, Nebr., are beginning to show up as windbreaks and woodlots for farm homes," writes County Extension Agent M. L. Gould. "The broadleaf varieties have done especially well, and many of these are now 5 and 6 feet high. The correlation between the way the trees were cultivated and the growth they made goes to prove that if you want success in a tree-planting project in Nebraska clean cultivation is one of the first things to see to for the first two years of the trees' life."

A course on renewable natural resources, pertaining to forests, soils, waters, and various forms of wild life, is being given this year in the University of Pittsburgh by O. E. Jennings. Doctor Jennings is head of the university's department of botany and director of the Lake Laboratory. About 20 people, mostly teachers, are taking the course.

Iowa Agriculturists Work to Check Erosion

Iowa suffers an agricultural production loss of about $3,000,000 annually owing to erosion, which exists in a more or less advanced form on 1,500,000 acres of land in the State, according to estimates by the State extension service. At least 500,000 acres of this land is eroded to such a degree that forestation is the only practical remedy, in the opinion of I. T. Bode, until recently extension forester of Iowa. In eight counties in the southeastern portion of the State a "Save Iowa Soils" program has been put into effect, largely through the initiative of Mr. Bode. This is a plan to combat erosion through cropping systems, through agricultural engineering measures such as soil-saving dams, terracing, and proper land drainage, and through forestry measures including tree planting and conservation of tree growth. Two trained agents are in charge of the work, each being assigned to a group of four counties.

During 1930 and 1931 Mr. Bode and local extension agents got some 65 demonstration forest plantings for erosion control under way, in 29 counties. They distributed more than 40 pounds of black locust seed to farmers in 1930 and 88 pounds in 1931, for use in growing trees for antierosion planting.

Within a few miles of Ames the Iowa Agricultural College has had an erosion-control project in progress for several years. The soil is deep sandy silt, the site a moderately sloping hillside. Here several large gullies had been formed, some of them almost reaching the highway and one heading for a farmhouse and barn. Silt and gravel had spread out over a considerable area in an adjoining field at the foot of the slope. Substantial dams have been placed across the larger gullies at the base of the slope. Tile piping about 12 inches in diameter has been put in to carry off water reaching above a certain level. At intervals smaller dams of a temporary nature have been made by setting a few locust or other posts in a convex curve across the gully, nailing strips of wire fencing to them, and filling in this barrier with brush, weeds, crushed sorghum cane, etc. Locust trees have been planted along the steep sides and upper slopes of the gullies and also in the bottoms, especially just back of and below the dams, and on top of the larger dams. In mixture with the locusts have been planted cottonwood cuttings and sycamore, elm, and other hardwood trees. Between gullies some northern white pine has been planted. This plan has succeeded to a striking degree in checking erosion. Eventually the entire area of 4 or 5 acres will be planted with trees.

First place among New Hampshire 4-H club foresters for 1931 was won by 14-year-old Warren Kolb, of Fremont. Working alone, Warren spent 450 hours cutting out weed trees from farm woodlands.

New Pulp and Paper Laboratory at Syracuse

A contract has been let for the construction of a $50,000 building at the New York State College of Forestry, Syracuse, N. Y., to house the semicommercial pulp and paper laboratories of the college, now in the basement of the present college of forestry building. The new building will be 160 feet long by 60 feet wide, a 1-story and basement structure containing approximately 18,000 square feet of floor space. The laboratories will include an analytical laboratory and a paper dyestuff laboratory. There will also be a paper-testing laboratory equipped with humidity and temperature control, a semicommercial digester room, and a paper-machine room.

The semicommercial digester room will contain digesters for manufacturing pulp by the various chemical processes, of a size to produce from 200 to 300 pounds of chemical pulp from a single cook. It is proposed to install a sulphite digester and an alkaline pulping digester, and equipment for manufacturing acid, caustic cooking liquors, and bleach liquors. Several pieces of semicommercial wood-preparing equipment, such as barkers, chippers, and chip screens, and a mechanical pulp grinder will be installed. The paper-machine room will contain pulp beaters, Jordan engines, and a 30-inch combination Fourdrinier and cylinder paper machine. The cylinder part of the machine has been designed with three cylinders to enable the college to experiment with the manufacture of paper boards, which are of particular interest to New York State because of the large number of paper-board mills in the State.

It is hoped to have this building completed in time for occupancy at the beginning of the 1932–33 college year.

Alumni of the Yale School of Forestry held their thirty-second annual reunion on February 22, 1932. They convened in Bowers Hall, which was built in 1931 with funds bequeathed by Edward A. Bowers, B. A., 1879, and which provides the School of Forestry with an auditorium, soils and wood-working laboratories, and various offices. Following the reunion banquet, at which Victor Beede officiated as toastmaster, E. C. Richards showed a series of motion pictures taken at the thirtieth alumni reunion and during his recent trip abroad to study forest and game relationships.

Forest Service Notes

A Meter for Forest Fire Danger

A "fire-danger meter" has been devised by H. T. Gisborne, of the Northern Rocky Mountain Forest Experiment Station, as an aid to the forest administrator in estimating how large a fire-control organization is called for by existing or probable forest fires. It has frequently been observed that supervisors of neighboring forests make dissimilar recommendations as to the fire-control forces they need in a given season or period although the forests are closely similar as to timber and fuel types and are subject to identical weather conditions. This fact, it is thought, is due largely to differences in the weight given by different supervisors to some of the individual factors in fire danger. Greater exactitude in administrators' estimates of fire danger would tend, of course, to reduce the number of instances in which avoidable fire losses occur because control forces available are inadequate and also the number of instances in which money is wasted by maintaining control forces larger than the fire danger justifies.

Mr. Gisborne's device represents an effort to summarize the results of fire research conducted by the Northern Rocky Mountain Forest Experiment Station, and knowledge accumulated by men having exceptional experience in fire-control work, in such a way as to facilitate correct weighting of each fire-weather factor. It is an adaptation of the slide-rule idea exemplified by exposure meters used in photography. On its two sides are integrated six fire-danger factors: Season of year, activity of fire-starting agencies, dryness or inflammability of forest fuels, relative humidity, wind velocity, and visibility distance. The meter defines seven classes of fire danger and indicates for each of these its administrative significance, that is, the character of the fire-control organization believed to be commensurate with it.

In its present form the fire-danger meter is being issued for trial and study, with the request that forest officers record the results they obtain from using it and report them at the end of the season. The experiment station has begun a very detailed analysis of its weather, fuel, and fire behavior data in order to check still further the integration of factors and the classification of fire danger.

The Northern Rocky Mountain Forest Experiment Station has been conducting a series of tests to determine how long and in what quantity tree seed stored in the duff of the old-growth forest remain viable. In these tests quantities of seed are stored under natural conditions for periods as long as eight years. About one-third of the viable seed so stored have germinated in the first two years of storage, before any opening of the forest canopy created light and moisture conditions in which the seedlings could live.

Growth After Cutting

By QUINCY RANDLES, United States Forest Service

Cutting operations in the ponderosa pine type in the Southwest began, of necessity, before it had been determined what methods of cutting would result in the prompt starting of a full stand of reproduction of the better species, and what type of cutting would result in maximum future yields of usable forest products. Intensive growth plots were started by the Southwestern Forest and Range Experiment Station following the early cuttings in order to obtain data on reproduction and growth. These plots, owing to the work involved in establishing them, were necessarily small in size and limited in number. The data from them, covering measurements for the past 20 years, are now of great value in management-plan work, particularly in fixing the length of the cutting cycle.

In order to obtain similar data early forest administrators measured the volume of timber reserved on certain cut-over areas, by a somewhat less intensive method which permits the inclusion of larger areas with a wider range of site and marking conditions. Some of these areas have been remeasured for volume. Under this method the volume increase since cutting represents growth on trees that were of merchantable size (12 inches in diameter at breast height) at the time of the initial measurement, plus the total volume of the trees that grew to merchantable size during the period, less mortality. An area of one section (640 acres) on the Coconino National Forest measured in 1909 had a volume increase up to and including 1930 of 860 board feet per acre, or 3.1 per cent annually, simple interest. A heavily cut area [1] of 9,342 acres on the Coconino with a stand of 659 board feet per acre after cutting in 1904 to 1912 had by the end of 1931 an increase of 526 board feet per acre, or 3 per cent annually. The average acre of this area is now stocked as follows:

Diameter class (inches):	Number of trees per acre
4 to 7	20.7
8 to 11	3.2
12 to 20	4.56
20 and upward	1.36
Total	29.82

On the Cibola Forest a section cut over during 1914–15 under the regular national forest marking system in force at that time showed a gain in 17 years of 891 board feet, or 52 board feet per acre annually, an increase equal to 6 per cent annually, simple interest. As in the instance first mentioned, this growth was made up of the total volume of trees that came into the merchantable class during the period plus the increase in volume of trees that were of merchantable size in 1915, less the mortality. In this case the excellent stand of small poles was a very material addition to the volume, as can be seen from a comparison of the rate of growth on this and the aforementioned area. The number of trees on the average acre in 1915 and 1931 is of interest:

Diameter class (inches)	Trees	
	1915	1931
	Number	*Number*
4 to 11	27.3	25.7
12 and upward	6.0	11.58
Total	33.3	37.28

The data obtained from these measurements show that net growth on cut-over areas varies according to several factors, but they give a very good basis for fixing the length of the cutting cycle. These data do not, of course, take the place of those obtained from intensive sample plots, but rather supplement them.

[1] Title to this land had been reconveyed to the United States subject to timber-cutting rights.

Variation in Weight of Slash Pine Wood and in its Proportion of Heartwood

By BENSON H. PAUL, United States Forest Service

Since wood is sold on a volume basis and wood pulp is sold on a weight basis, it is obviously to the advantage of the pulp manufacturer to purchase wood of maximum density. Forest Products Laboratory studies of the wood in second-growth slash pine stands of pulpwood size have revealed differences in weight averaging approximately 20 to 30 per cent between samples of wood taken from the trunk of the same tree at different heights. Comparison of the average weights of wood from different stands discloses even greater average differences. The lightest average weight determined was that of wood obtained from a very young, rather incompletely stocked stand of about 220 trees per acre in which the trees ranged mostly from 8 to 16 years in age and from 5 to 10 inches in diameter at breast height. The average specific gravity (weight divided by the weight of an equal volume of water) of the wood of 37 trees from this stand, based on samples taken at intervals of 4 feet in the height of the trees, was 0.45.

In another stand in the same locality the average specific gravity of the wood as determined by an analysis of 26 trees was 0.52. This stand was 27 years old. It had been thinned to a density of about 300 trees per acre at the age of 24 years. The trees ranged from 6 to 13 inches in diameter at breast height, and the stand was estimated to contain about 30 cords of pulpwood per acre.

In a third slash pine stand containing 840 trees per acre, 30 to 35 years of age and from 5 to 8 inches in diameter at breast height, the average specific gravity of samples taken at 4-foot intervals in 34 trees was 0.55. This stand was fully stocked and contained approxi-

mately 58 cords of pulpwood per acre. Because of the greater age of the trees, pulpwood sticks obtained from this stand were externally smoother and contained fewer knots than those obtained from the other stands.

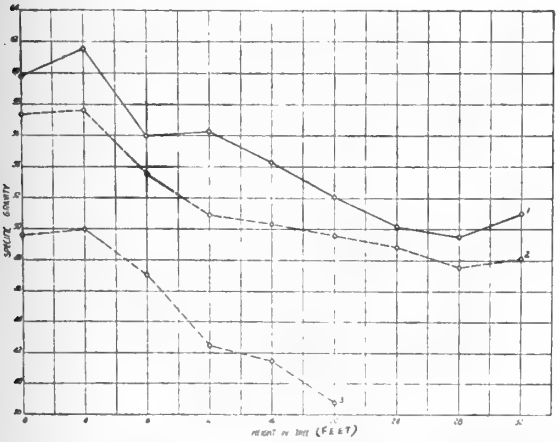

FIGURE 1.—Average variation in the specific gravity of slash pine wood from the base to the top of the merchantable length of trees of pulpwood size:

1. Trees 30 to 35 years of age
2. Trees 27 years of age
3. Trees 8 to 16 years of age

The variation in the specific gravity of wood at different heights in trees in the three stands is shown in Figure 1. The significance of specific gravity of wood in terms of pulp yield is shown by Table 1, based on data obtained when wood from the three stands was pulped by the Kraft process under identical conditions.

TABLE 1.—*Specific gravity, weight, and pulp yield of slash pine wood from three stands*

Average specific gravity of wood	Weight of wood per cubic foot	Weight of wood per cord [1]	Yield of screened pulp per unit of weight	Yield of screened pulp per cord [1]
	Pounds	*Pounds*	*Per cent*	*Pounds*
0.45	28.0	2,240	44.6	999
.52	32.5	2,600	47.4	1,232
.55	34.4	2,752	47.7	1,313

[1] The solid content of a cord of wood is assumed to average 80 cubic feet.

Since there is considerable interest at the present time among papermakers as to the influence of heartwood on the pulping qualities of wood of southern species it seemed desirable to compute the volume of heartwood in the trees from each of the three stands, although the quantity of heartwood contained in second-growth stands of slash pine is relatively small. Accordingly measurements were made of the diameter of the heartwood and of the average diameter of the trees at the place where each specific-gravity sample was taken. Heartwood was not present in all trees or at all heights in the trees. The wood from the trees 8 to 16 years of age contained no heartwood; that from the 27-year-old stand contained 3.7 per cent of heartwood; and that from the 30 to 35 year old stand contained 4.3 per cent of heartwood.

Table 2 shows the specific gravity values for the wood at intervals of 4 feet in height in the trees and the proportion of heartwood found in the pulpwood sticks from different heights in the trees. Figures for percentage of heartwood are based on the total volume of the pulpwood sticks and the total volume of the heartwood portion of the sticks.

Although the data here presented show that judicious selection of second-growth slash pine wood may mean a gain of more than 300 pounds in the yield of pulp per cord, and that the heartwood content of slash pine is small, many points relating to the use of slash pine for pulp remain to be investigated. Among these are the desirability of excluding all heartwood from slash pine wood used for pulp, the optimum rotation for growing a crop of pulpwood trees, the cost of cutting pulpwood from trees of different sizes, and the ease of pulping and bleaching versus the yield of pulp per cord. Some of these questions are now being studied by the Forest Products Laboratory for the different species of southern pine. Their solution will make possible more intelligent management of extensive second-growth southern pine stands that are now in the early stages of growth and will help to determine the best use for a large proportion of the 60,000,000 acres of land included in the coastal plain area of the South.

TABLE 2.—*Specific gravity of the wood of slash pine and percentage of heartwood in pulpwood sticks at various heights in the trees, for stands of different ages and stocking*

Age of trees, years	Number of trees per acre	Average diameter at breast height	Specific gravity and percentage of heartwood at different heights																			
			Stump		4 feet		8 feet		12 feet		16 feet		20 feet		24 feet		28 feet		32 feet		36 feet	
			Specific gravity	Heartwood	Specific gravity	Heartwood	Specific gravity	Heartwood	Specific gravity	Heartwood	Specific gravity	Heartwood	Specific gravity	Heartwood	Specific gravity	Heartwood	Specific gravity	Heartwood	Specific gravity	Heartwood	Specific gravity	Heartwood
		Inches		*Per cent*		*Per cent*		*Per cent*		*Per cent*		*Per cent*		*Per cent*		*Per cent*		*Per cent*		*Per cent*		*Per cent*
8–16	220	5–10	0.496	0	0.500	0	0.470	0	0.423	0	0.415	0	0.388	0	0.440	0	0.407	0				
27	300	6–13	.574		.576	[1] 3.2	.535		.509	[1] 5.0	.503		.496	[1] 3.9	.489		.475	[1] 2.7	0.481		0.478	1.1
30–35	840	5–8	.598	2.9	.615	4.6	.560	5.4	.563	5.6	.543	4.7	521	4.3	.502	3.4	.495	2.7	.510	1.5	.447	0

[1] Average for 8 feet of stem length.

Number and Distribution of Resin Passages in Slash Pine

By Victor C. Hobert, United States Forest Service

In order to supplement information made available many years ago by Filibert Roth on the distribution of resiniferous tissue in longleaf pine (*Pinus palustris* Miller), [2] a study was made of slash pine (*Pinus caribæa* Morelet) material obtained from three vigorous trees about 14 to 19 years of age that grew near Tarboro, Camden County, Ga.[3] Six disks were cut from each tree at heights of about 2, 10, 20, 30, 40, and 45 feet above the ground. Two blocks containing, respectively, the 1912 and 1917 growth rings (relatively recent normal rings formed before the trees were turpentined) were cut from each of four radii on each disk and used for preparing the sections examined with the microscope.

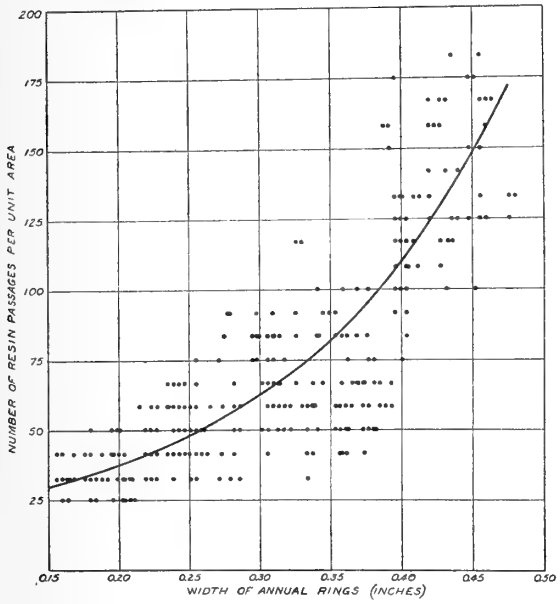

FIGURE 1.—Number of vertical resin passages in slash pine per unit area (one annual ring in width and one inch in length)

The number of fusiform rays containing horizontal resin passages was determined with a magnification of about 65. Five fields of 0.0021 square inch each were examined on each tangential section. The data thus obtained from 525 fields showed that there were, on the average, 0.71 fusiform rays in each square millimeter, or 458 per square inch of tangential surface. The minimum was none per field; the maximum, 1.27 per square millimeter, or 819 in one square inch.

[2] Mohr, Charles: Timber Pines of the Southern United States, U. S. Department of Agriculture, Division of Forestry, Bulletin 13. Section by F. Roth, p. 152. 1897.

[3] These trees were part of a group used in an investigation of naval-stores production by Austin Cary, logging engineer, and Eloise Gerry, senior microscopist, United States Forest Service, in cooperation with C. L. McCarthy, owner of the trees.

The average number of linear rays (rays containing no resin passages) was found from the same tangential sections to be 31 per square millimeter, or about 20,000 per square inch of tangential surface. The minimum was 25.7 per square millimeter, or about 16,500 per square inch; the maximum was 36.5 per square millimeter, or about 23,500 per square inch.

The corresponding figures for the distribution of longleaf pine structures given by Roth, loc. cit., were: Fusiform rays scattered, sometimes none per square millimeter and again one resin passage per 1.5 to 2 square millimeters or 300 to 400 per square inch; linear rays, 21 to 27 per square millimeter or 15,000 per square inch of tangential section.

The data obtained in this study of slash pine yielded no evidence that the width of the annual ring bears any relation to the number of linear and fusiform rays per unit area of tangential surface.

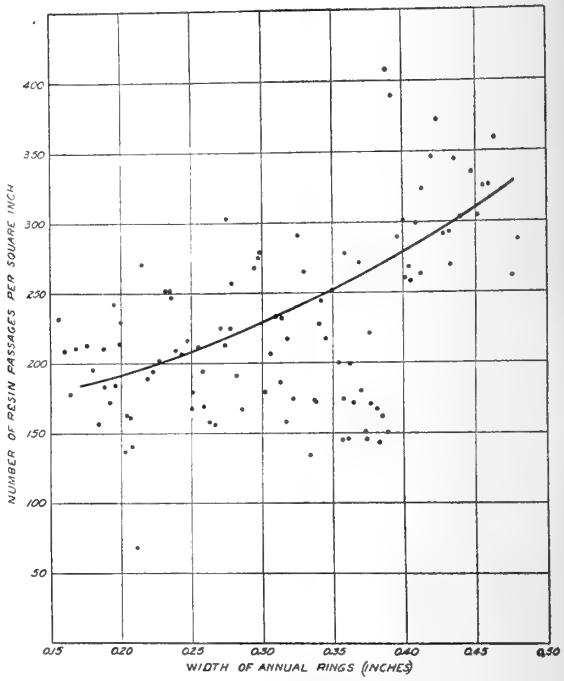

FIGURE 2.—Number of vertical resin passages in slash pine per square inch

A study of the number of the vertical resin passages present was made on cross sections cut from the same blocks as the tangential sections. An average of 219 vertical resin passages per square inch (0.34 per square millimeter) of cross section was found, with a maximum of 408 and a minimum of 68 per square inch. Figure 1 shows the average number of passages per unit area, i. e., tangential inch, for each ring width examined. It was found that generally more resin passages were present in the wider rings.

From Figure 2 it is evident that there is a tendency for a given area made up of wide rings to have more vertical resin passages per square inch than an equal area

made up of narrow rings, although this is not always the case. These data differ from the findings of Münch for Scotch pine, which indicated that the number of vertical resin passages per square millimeter was relatively greater in narrow rings and was so consistent that Münch's results could be expressed in a mathematical formula.[4]

In the material studied approximately 60 per cent of the vertical resin passages were in the summerwood.

Among the negative results obtained were the following: Crown development bore no apparent relationship in this material to the number of vertical or fusiform resin passages formed. No consistent differences in the number of vertical or horizontal resin passages as related to height in the tree were found, nor did the average number per tangential inch of the 1912 annual ring show any significant difference from that of the 1917 annual ring.

It is believed that marked differences in the number of resin passages might be found if extremely narrow or extremely wide annual rings were compared.

Portable Radio Sets for Forest Use

Two types of portable radio sets have been developed for use by field forces of the Forest Service in 1932. The smaller set is about 8 inches square and weighs less than 10 pounds. It receives voice and transmits code, and will enable "smoke chasers" to communicate with near-by lookouts or dispatchers. About one hour's training is adequate to enable workmen to use it. The other set weighs about 25 pounds and transmits as well as receives voice. It also is easy to operate. It is expected to be of greatest use at lookouts, crew camps, and other such stations. The "safe" radius of communication for each set is 10 miles. In practice the "featherweight" set has transmitted code in level country to a distance of 100 miles, and the larger set has transmitted voice 50 or 60 miles. The range of the latter set can be extended by adding more batteries, up to the maximum workable weight of 40 pounds.

Experimental work on the adaptation of radio to national forest administrative purposes is being continued by A. G. Simson, of the Portland, Oreg., headquarters of the Forest Service.

Redwood planting data supplied to the California Forest Experiment Station by lumber companies and by Mason & Stevens, consulting foresters, show that 6,365,000 trees have been planted on 25,500 acres at a cost of $225,000. The costs averaged $10.50 per acre for Mendocino County and $7.32 per acre for Humboldt County. Lumber company records show an average survival of 47 per cent. Survival and growth appear to have been best on north, east, and west exposures, and on areas that were planted with 1–1 redwood stock within one year after logging.

[4] Münch, E.: Naturwissenschaftliche Grundlagen der Kiefernharznutzung. Biologischen Reichsanstalt für Land- und Forstwirtschaft, Bd. 10 (1): 26. 1919.

Merger Abolishes Four National Forests

Under Executive orders recently signed by President Hoover, in the interest of more economical administration of national-forest land in Montana the number of national forests in that State has been reduced from 16 to 13. The lands formerly constituting the Madison, Missoula, and Beartooth National Forests have been distributed among other national forests, and some other boundary changes have been made. Similar action has been taken by the President respecting three of the national forests in the State of New Mexico. The Datil Forest has been abolished and the lands formerly included in it have been transferred to the Gila and Manzano National Forests. The name of the latter forest has been changed to "Cibola," commemorating the "Seven Cities of Cibola" which were sought by the early Spanish explorers and which were supposed to lie in the locality where this forest is situated.

By Executive order of February 25, 1932, the boundaries of the Bandelier National Monument, in the State of New Mexico, were slightly modified, and jurisdiction over this monument was transferred from the Forest Service of the Department of Agriculture to the National Park Service of the Department of the Interior.

Grazing Fees Reduced for 1932

Fees for grazing domestic livestock on the national forests during 1932 have been reduced by 50 per cent. In deciding on this reduction the Secretary of Agriculture was influenced by conditions facing stockmen as a result of the 1931 drought and of heavy snows during the winter of 1931–32 which compelled them to purchase unusual quantities of high-priced feeds. The order reducing the rates is effective for one year only.

In 1931 the charge for grazing cattle on the national forests averaged 14½ cents per head per month, for an average season of five and one-half months, and the corresponding fee for sheep averaged 4½ cents per head per month, for an average season of 3½ months.

More than 26,000 ranchers and stockmen will be directly benefited by this emergency action. Animals for which national-forest grazing fees were paid in 1931 totaled 1,375,467 cattle and horses and 6,707,328 sheep and goats.

W. B. Rice, supervisor of the Payette National Forest, Idaho, recently visited 13 forest schools in the eastern half of the United States, at which he delivered a series of lectures on various phases of the work of the United States Forest Service. Such a lecture tour of the forest schools has been conducted by the Forest Service in each of six successive years. The six lecturers have represented, respectively, as many national-forest regions of the West.

General Forest News

Eddy Tree Breeding Station Carries on Under New Name

By Lloyd Austin, Institute of Forest Genetics

"Institute of Forest Genetics" is the name by which the Eddy Tree Breeding Station, at Placerville, Calif., will be known in the future. The new name is believed to be more expressive of the nature of the research work being carried on. Personnel and objectives of the institution remain as before.

Steps are being taken to insure the long-continued existence of the institute by providing for government by a self-perpetuating board of 15 trustees and by setting out to obtain a permanent endowment. Trustees are being elected from among men prominent not only in forestry but in allied sciences and in business.

The Institute of Forest Genetics is the only institution of its special kind in the world. A primary objective is to develop an improved, rapid-growing forest tree that will, on the better sites, attain a diameter of 16 inches and a height of from 70 to 80 feet in 25 years or less. The desired tree would have wood of good quality and would later be bred to have unusual resistance to insects, disease, and drought. Development of such a rapid-growing tree is expected to give great stimulus to reforestation by making it profitable and desirable for the individual landowner to grow timber as a crop.

Results achieved since the institute was established in 1925 indicate that this objective is entirely reasonable. Great differences have been found in the inherent vigor, or growth rates, of individual trees of the same species, and it is indicated that maturity of planted forests can be hastened considerably by scientific selection of seed sources alone. Twenty-seven thousand seedlings of 765 known ponderosa pine trees were grown under uniform conditions in one comprehensive test of inherent vigor.

Hybridization of species is another line of work being followed out by the institute. In this way it is often possible to bring about marked improvements in plants and animals. The hybridization experiments which the institute is carrying on with pines are the most extensive ever undertaken. Valuable new methods for artificial pollination and for vegetative reproduction have been worked out. For the first time, so far as is known, pines have been budded successfully.

For the present the institute is concentrating attention on the pines among softwoods and on walnuts among hardwoods. More than 100 species and important varieties of pines are growing in the arboretum at Placerville, a number greater than that of the famous pinetum of Kew Gardens.

The founder of the institute, and a member of the new board of trustees, is James G. Eddy, a Washington lumberman who had the imagination to see in Luther Burbank's achievements with domestic plants a key to the solution of the reforestation problem.

A Guide for Estimating Cull in Northern Hardwoods

A set of suggestions for estimating cull in northern hardwoods has been formulated by Perley Spaulding and G. H. Hepting, of the Bureau of Plant Industry, and M. Westveld, of the United States Forest Service, as an outgrowth of studies carried out on the Gale River and Bartlett Experimental Forests on the White Mountain National Forest, N. H., and of observations in sawmills and on logging areas at Easton, N. H., and Wenlock, Vt. The investigators present as follows certain characteristics of the principal fungi attacking northern hardwoods and their advice as to estimating cull where these fungi are present:

Fomes igniarius: Large, brown to black, woody fungus, brown beneath, usually entering through wounds. Fruiting bodies indicate serious loss, extending 15 feet or more, in all species. Cull heavily. Occurs on all hardwoods.

Fomes nigricans: Usually sterile, clinker-like, black fungus. Causes open wounds with protruding, swollen edges on which the sterile black masses form. Cull heavily. Occurs on the birches.

Fomes connatus: Small, white, corky polypore usually with moss on the upper surface. Enters branch scars, bruises, or open seams. Rot extends but 1 or 2 feet up and down from the fruiting body. An average cull of 3 feet is sufficient. Occurs primarily on the maples.

Fomes applanatus: Large, flat, woody fungus with grayish upper surface and white lower surface which blackens when scratched. Common as a wound parasite. Rot generally extends 4 to 6 feet in each direction from the fruits.

Suggestions and observations applying to individual species of northern hardwoods are as follows:

Sugar maple: Cull lightly. Chief rot is *Fomes connatus*, for which average cull of 3 linear feet is sufficient. Fruiting bodies of *Fomes igniarius* indicate serious loss. Decayed knots are less serious than in yellow birch. Seams generally go deeper than in yellow birch and require a deduction in the scale.

Open scars are often caused by maple-borer injury. If the dead wood in such scars is kept moist by adhering dead bark, rot is apt to enter. In such cases cull several feet. If the dead wood of the scar is bare and

new growth below the wound is cupped so as to hold water, cull 2 to 3 feet; if new growth below the wound is not cupped, cull only for mechanical injury.

SOFT MAPLE: Cull heavily. *Fomes connatus* is frequent; cull 3 feet each way from fruiting body. *Fomes igniarius* is common; cull very heavily, as fruiting bodies mean complete loss in most cases. Swollen knots and seams are apt to indicate black heart if not rot.

YELLOW BIRCH: Cull moderately. Butt rots require average cull of 3 feet at the mill. *Fomes igniarius* is common; cull 50 to 100 per cent.

Open cankers with depressed center and swollen edges upon which irregular, black, clinker-like, rather brittle masses occur indicate 50 to 100 per cent loss. Decayed knots are more serious than in sugar maple. Seams seldom require a discount unless they fold inward.

PAPER BIRCH: Cull moderately. *Fomes igniarius* fruits mean nearly total loss. Open, depressed cankers with black center or edges mean heavy loss; cull 75 per cent or more.

BEECH: *Fomes igniarius* is common and causes 50 to 100 per cent loss. One fruiting body on lower trunk with large rotten knot or stub on upper trunk indicates total loss. For *Fomes applanatus*, cull 4 to 6 feet from the fruits. Rot in beech is extremely deceptive; except in the case of *Fomes igniarius*, it starts and ends abruptly. In stands where *Fomes igniarius* is plentiful, stems with rough, swollen knots should be culled even though no conks are in evidence.

Studies and observations showed that old logging scars, porcupine work, open seams, etc., if they extend to the ground so as to be kept moist and open enough for ready entry of air, require a cull of from 6 to 8 feet. If they are located 6 inches or more above the ground and so remain dry, no cull is needed except for the mechanical injury. Wet wounds which the air can not enter freely often remain unrotted.

Butt rot is more serious if it starts at or below ground level than if it starts above ground level. Quantity of interior defect is proportional to size of defective surface knots. A churn-butted tree is not invariably one affected by butt rot. Hardwood timber growing in low, wet places is apt to be pretty defective, while hardwoods on well-drained soils are generally fairly sound. Hardwood stands that have been heavily culled for spruce and fir are more defective than stands from which only a negligible portion of the softwood timber has been removed.

Northern white pines in Carrol County, N. H., have been left practically untouched by porcupines that have girdled large numbers of softwoods of other species intermixed with the white pines or growing near by, writes Blister Rust Control Agent S. H. Bloomer. The trees for which the porcupines showed preference were Norway pine, Scotch pine, fir, and spruce.

Forest Insects in 1931

(From the Insect Pest Survey, published by the United States Bureau of Entomology)

Less defoliation was caused by the gipsy moth (*Porthetria dispar L.*) in the summer of 1931 than for several years, and in most of the infested area the trees were practically free from gipsy-moth feeding. Defoliation was severe in the counties of Bristol, Plymouth, and Barnstable, Mass. Areas in New England that were recorded as showing some feeding by the gipsy moth caterpillars totaled 204,720 acres. More than half of this, however, was classified as less than 10 per cent defoliated, and of the remainder more than half (54,710 acres) was in the southeastern section of Massachusetts. The New York Conservation Department found no infestation of the gipsy moth on Long Island in 1930 and 1931, except in the towns of North Hempstead and Oyster Bay. In the former, 110 egg clusters were discovered in 17 infested localities; in the latter, 67 were found in 24 infested localities. Practically all these infestations were in woodland. During the first half of 1931, no gipsy-moth infestation was found in the portion of the barrier-zone area in Vermont that was scouted. Early in July, 1931, a scattered infestation was found in Colebrook, Conn., near the Massachusetts State line. Numerous infestations, many of them in woodland, have existed during the past two years in a group of towns including Sandisfield and New Marlboro, Mass., and North Canaan, Canaan, and Norfolk, Conn. Beyond the New York barrier zone infestations were somewhat fewer than during the previous fiscal year and marked progress was indicated in cleaning up infested locations. No new gipsy-moth infestation has been found in New Jersey since May, 1929. The southern half of Bridgewater Township and the northern half of Hillsboro Township have been examined with special care, as this area was the most heavily infested when the insect was first found in New Jersey.

The brown-tail moth (*Nygmia phæorrhœa* Don.) has not been found outside the regulated area this year.

During 1931 the satin moth (*Stilpnotia salicis* L.) was found in new localities in the following counties and quarantine regulations were modified to cover the additional areas: Piscataquis, Somerset, and Franklin Counties, Me.; Orange County, Vt.; Berkshire and Franklin Counties, Mass.; and Hartford, Litchfield, New Haven, and Fairfield Counties, Conn.

The forest tent caterpillar (*Malacosoma disstria* Hbn.) was generally reported from the New England and the northern Middle Atlantic States as very scarce. Late in April the insect was active and abundant in Alabama and Louisiana. In Louisiana, after defoliating the sweet gum and willow it attacked oak and wild blackberries and also inflicted considerable injury on strawberries by eating the flowers. During May several hundred acres of forest land in Fluvanna County, Va., were completely defoliated. A similar outbreak occurred in Buckingham County, Va. These were said to be the

worst outbreaks of this insect ever experienced in that State. From June 10 to June 20 the moths were so numerous in the streets of Lynchburg and Roanoke, Va., that merchants were forced to turn out their window lights. Adults were observed early in May in large numbers at Orlando, Fla. During June some defoliation was reported from Hancock County, Me. The eastern tent caterpillar (*Malacosoma americana* Fab.) on the whole was not abnormally numerous in 1931 throughout the New England, Middle Atlantic, and South Atlantic States. On the other hand, reports of unusual numbers of this insect were received from Arkansas and Texas. During the late spring it was reported as defoliating trees, especially wild black cherry, in parts of southern Maine and was also recorded as abundant in restricted localities in the other New England States. The California tent caterpillar (*M. californicus* Pack.) was extremely prevalent in late March around Phoenix, Ariz., where it was defoliating cottonwoods and severely injuring apricot foliage.

The western tent caterpillar (*Malacosoma pluvialis* Dyar.) was again abundant on alder, poplars, and willow along the coast of Oregon and the Columbia River. Defoliation of these trees was not so severe as in 1930, however, and only in a few places were trees completely stripped.

Adults of the saddled prominent (*Heterocampa guttivitta* Walk.) issued in the New England area during May and early June. Eggs hatched in the Berkshire Hills of Massachusetts on June 10 and in the White Mountains of New Hampshire on June 16. This insect, which was at the peak of its abundance in 1930, is still numerous throughout western Massachusetts, southern Vermont, and New Hampshire. For the greater part the defoliation was confined to maple and beech.

The bagworm (*Thyridopteryx ephemeræformis* Haw.) was reported as very abundant on arborvitae in George County, Miss., in February. In June the insect was reported from Columbus, Ohio. During July reports were received of serious damage to evergreens in Vermont, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, and Ohio. The bagworm was quite generally reported during August from New York westward to Indiana and Kansas, and southward to Mississippi and Florida. Reports continued to come in during September from this same general area.

The mountain pine beetle (*Dendroctonus monticolæ* Hopk.), which has been sweeping through all the lodgepole and western white pine stands of the Pacific Northwest, is now decreasing in many sections, owing largely to a lack of suitable host material. The most serious epidemic in California is in the Medicine Lake district of the Shasta National Forest. There is evidence of a decided increase in some stands of sugar pine in the Sierra Nevadas. In Oregon and Washington epidemics were noted during the year on the Fremont, Crater, and Deschutes National Forests, on the Klamath Indian Reservation, and throughout the Cascades of Washington. The outbreak in Mount Rainier National Park was completely under control in 1931. Increased losses occurred during the year throughout the lodgepole pine forests of Montana and Idaho; on the Beaverhead National Forest alone more than 12,000,000 trees were destroyed. There was also a marked increase in losses in Yellowstone National Park. In central Idaho the infestation has spread throughout the Salmon, Challis, Payette, Weiser, and Idaho National Forests and is now moving northward. Similar outbreaks continued to ravage the pine forests on the Kaniksu and Pend Oreille National Forests.

In general, western pine beetle (*Dendroctonus brevicomis*) infestation is not intensifying materially. Losses as high as 8 per cent of the stand were observed, however, along the western slopes of the Sierra Nevadas on the Sierra, Stanislaus, and Sequoia National Forests, Calif. Losses were particularly heavy in Oregon on the Fremont, Deschutes, Ochoco, and Malheur National Forests, the Klamath Indian Reservation, and the private timberlands adjacent to these areas. In southern Oregon the infestation is increasing and reached 3 to 4 per cent of the timber stand in 1931, while on the Ochoco and Malheur areas timber losses from this cause ran from 5 to 7 per cent. It is estimated that approximately 600,000,000 board feet of ponderosa pine was killed by this beetle during the year throughout Oregon and Washington.

The southern pine beetle (*D. frontalis* Zimm.) was exceedingly scarce throughout the forests in the Southeastern States. This situation was believed to be due to the nearly complete natural control of the beetle during the late fall and winter of 1930–31, brought about largely through abnormally high temperatures and (to a lesser extent) through the activities of birds, particularly woodpeckers. As a result of high temperatures during October and November of 1930, broods that would normally have overwintered in the larval, pupal, and adult stages matured and emerged in the fall. A large percentage of these broods were destroyed by woodpeckers as they reached the mature larval, the pupal, and the callow adult stages. Insects that emerged and escaped the woodpeckers attacked trees but were unable successfully to establish broods in them so late in the season. The only activity noted during 1931 was in the vicinity of Asheville, N. C., where the rainfall deficiency continued to be somewhat greater than in surrounding noninfested areas. Near Asheville several spot outbreaks occurred, becoming more noticeable in the late summer and fall months.

Pine shoot moths (*Rhyacionia* spp.) are causing considerable concern in the Northeastern States as serious pests to cultivated conifers, particularly nursery stock, upon which they destroy the terminals. Reports of serious damage to Scotch pine (*Pinus sylvestris*), Norway pine (*Pinus resinosa*), mugho pine (*Pinus montana mughus*), Austrian pine (*P. nigra*), and other species of pine nursery stock in Pennsylvania, and in the vicinity of New Haven, Conn., and the metropol-

itan district of Boston, Mass., by *Rhyacionia buoliana* Schiff., were received. *Rhyacionia frustrana* Scudd. appeared in large numbers in a plantation of pitch pine (*P. rigida*) during August at Cheyney, Pa., and also occasioned considerable injury to young "spruce pine" (*Tsuga canadensis*) at Laurel, Miss. A new species of pine shoot moth (*Eucosoma gloriola*) described by Heinrich[5] was found to be quite generally abundant last year in the lateral shoots of northern white pine (*P. strobus*) at North Stamford, Conn. During 1931 it was sufficiently numerous at some places to cause appreciable injury. The moths from the type material emerged during the early part of May, 1931, from larvæ collected by E. P. Felt during early July, 1930.

The first adults of the spruce budworm (*Harmologa fumiferana* Clem.) of 1931 were observed at Fargo, N. Dak., on June 17. This insect defoliated balsam fir and several species of pine over large areas in Wisconsin and North Dakota. During early July, on areas in Wisconsin that in some cases covered entire townships practically every tree was completely defoliated. An outbreak of this insect was first recorded in Cody Canyon, Shoshone National Forest, Wyo., in 1926, and since that time has spread over a tremendous acreage and destroyed large quantities of Douglas fir; this outbreak decreased somewhat in severity during 1931. As a result of an outbreak on the Ochoco National Forest, Oreg., extensive stands of white fir, Douglas fir, and larch are dead and dying.

The hemlock looper (*Ellopia fiscellaria* Guen., var. *lugubrosa* Hulst) during the past three years has built up a tremendous epidemic in Pacific and Grays Harbor Counties of Washington. It is estimated that during 1931 this insect killed 90,000,000 board feet of hemlock, with some western red cedar and Sitka spruce, in Pacific County, and 10,000,000 board feet in Grays Harbor County. A total of 162,000,000 board feet has been killed in Pacific County during the three years of the epidemic.

The larch case bearer (*Coleophora laricella* Hbn.) was reported as severely damaging extensive stands of larch in Maine, Vermont, Massachusetts, and Pennsylvania. In three counties in Maine the insect defoliated from 50 to 100 per cent of every stand of larch. This damage continued into June, when reports of damage were coming also from Massachusetts, New York, and New Hampshire. A late brood of this insect defoliated larch in September in New York.

Birches were very severely attacked by the birch skeletonizer (*Bucculatrix canadensisella* Chamb.) during the late summer and early fall in Maine, New Hampshire, Vermont, New York, Wisconsin, and Minnesota. In many places in the Adirondacks of New York State the birches were completely defoliated. In northern Maine hundreds of thousands of acres of birch were browned by this insect. The birch leaf-mining sawfly (*Phyllotoma nemorata* Fall.) was associated with *B. canadensisella* throughout the New England area and New York.

The leaf roller *Cacœcia conflictana* Walk. has been known for a good many years as a poplar pest in western Canada, but seems to be a comparatively new pest in the United States. In 1931 we received a report of approximately 43,000 acres of poplar being defoliated in the Moosehead Lake district in Maine. The adults were in flight the last week in June and by the middle of July another brood of larvae were feeding on the poplars.

Overwintering adults of the elm leaf beetle (*Galerucella xanthomelæna* Schrank) were abundant in late April at Narragansett, R. I., and during the latter part of June eggs and small grubs were very numerous in southern New England. Indications of the work of this insect were also observed during June in West Virginia, and it was reported as very abundant at Jackson and Lexington, Oreg. During July it was quite generally reported from New Hampshire southward along the Atlantic seaboard to Maryland, with occasional outbreaks in Ohio and Kentucky. Early in the spring of 1931 this beetle was recorded for the first time in Yosemite National Park, Calif., and late in the season a report was received that it was spreading rapidly in many parts of California.

In April of 1931 the beech scale (*Cryptococcus fagi* Bar.) was found in the vicinity of Boston, Mass. A preliminary survey disclosed its presence in three distinct areas: One between Augusta and Belfast in Maine, another including Gloucester, Essex, Manchester, and Beverly in northeastern Massachusetts, and a third including the Boston district. As far as is known this insect limits its attack to beech, of both the American and the European species. It is believed, both in Europe and in Canada, that the slime flux often associated with the insect is more dangerous to the trees than the scale itself. This insect is recorded as prevalent in the Maritime Provinces of Canada.

During the year 654 cases of damage by termites (Isoptera) were brought to the attention of the Bureau of Entomology. These cases were scattered over 36 States, the District of Columbia, the Philippine Islands, and Hawaii.

New evidence as to the water-holding function of forest litter and leaf mold has been brought out by an experiment at the Guthrie, Okla., soil-erosion station of the Bureau of Chemistry and Soils. Two adjoining plots of virgin post oak woodland were put under control, both having the same soil, slope, and vegetative cover. One plot was burned over, the other was left undisturbed. During a 9-month period 28,250 gallons of water per acre were lost by run-off from the burned area, while only 338 gallons per acre were so lost from the unburned area.

[5] Proceedings of the Entomological Society of Washington, vol. 23, no. 8, p. 196, Nov. 23, 1931.

A Soil-Saving Cultivator

A soil-saving cultivator has been developed experimentally by the Bureau of Chemistry and Soils, among the possible uses of which is the preparation of eroding lands for forest planting. The novel feature of this implement is a set of alternating shovels which work up and down in such a way that as the machine moves forward it leaves behind it rows of holes alternating with piles of soil. As now constructed the machine makes approximately 10,000 holes to the acre, each hole having a capacity of from 2 to 3 gallons. These holes collectively impound a large quantity of water, and by holding it still enable it to soak into the ground. The overflow from the holes must zigzag around the piles of soil, with the result that the rate of run-off is slowed down and absorption is increased. A set of regular cultivator shovels precede the digging shovels. The furrows which they create are destroyed by the digging shovels. It appears that the surface condition produced when the machine is run up and down hill should be as effective in conserving water as that produced when operation follows the contours.

The McCubbin Gum Tree

A 42-year-old gum tree of the species *Eucalyptus viminalis* on the property of J. C. McCubbin, 3 miles west of Dinuba, in Tulare County, Calif., is 131 feet tall and has a girth of 22 feet 10 inches at a height of 3 feet from the ground. The girth at the ground is 30 feet 8 inches, and the spread of the crown is 123 feet.

The owner relates that he obtained this tree in the spring of 1889 as one of 100 to be used in planting a grove. While awaiting planting the boxful of trees spent a day in a corner of a barn. During that time a hen, choosing the box as a nesting place, scratched some of the trees out by the roots and thrashed the tops out of several others. The tree that has now made such a growth record was one of those beheaded by the hen. Rejected for use in planting the grove, it has grown up in the open.

Before the tree was planted, about 8 or 10 inches of highly fertilized soil from an old sheep corral was used to raise the level of the planting site to that desired in connection with an irrigation scheme. Aside from this, no fertilizer has been used.

Percolation of water through soil is governed by the presence of holes, cracks, and crevices, irrespective of their origin, to a much greater extent than by the mechanical composition of the soil, according to findings of the Bureau of Chemistry and Soils. The capacity of the soil to disperse in water and to fill such cracks is the most important factor in regulating the rate of water percolation through soils.

International Research Union Has 85 Members

Ordinary members of the International Union of Forest Research Organizations numbered 85 at the beginning of 1932, 31 new members having been admitted during the preceding year. The union now has members in 31 different countries. It will hold a congress in Nancy, France, September 4–11, 1932. (The section of forest entomology will meet at Nancy during the second half of July, following the Fifth International Congress of Entomology, at Paris.)

The work of the union's bibliographical committee has been interrupted by the death of the chairman of the committee, A. Opperman, of Denmark. Of the nine members of the committee formed to report on actual methods of laying out and measuring sample plots, the French and Prussian have already delivered reports and the others have promised to present such reports before the 1932 congress. Committee reports are expected also on standardized description of forest stands, nomenclature of humus forms, and entomology. In pursuance of the union's desire to facilitate international exchange of forest seed of known origin the secretary general publishes an incomplete list of kinds of seed which members of the union may be able to deliver. Even in poor seed years he has been fairly successful, he reports, in providing members with the kinds of seed that they have requested.

The bark and wood of young Chinese chestnut trees grown at Bell, Md., have been found by the Bureau of Chemistry and Soils to have practically the same tannin content as the bark and wood of near-by second-growth American chestnut trees of the same age. A sample of Florida mangrove bark submitted to the bureau was found to contain, on the moisture-free basis, 26 per cent tannin and 13.5 per cent nontannins. This tannin content is about 10 per cent less than that of the imported mangrove bark.

A special fire problem of the redwood district is involved in the fact that when redwoods are cut the immense trunks are difficult to handle and it is necessary to burn the slash before the logs can be removed. The slash must be dry in order to burn, but the burning should take place immediately before a rain. The Eureka, Calif., office of the Weather Bureau endeavors to assist lumber companies in the district by predicting when weather conditions will be suitable for burning slash.

The Forestry Branch of the Indian Service reports completion of an extensive grazing reconnaissance covering 45,000,000 acres of Indian lands.

Foreign Notes

Economy Program Scales Down British Afforestation Plan

Great Britain's economy program, approved by Parliament in September, 1931, cut practically in half the expected appropriations to the forestry commission for 1932 and subsequent years of the decade beginning with October, 1929. Under the previously existing policy, appropriations to the commission during that decade would have totaled £9,000,000. The decrease in the 1932 appropriation is £478,000. Acquisition of land was to have proceeded at the annual rate of 60,000 acres of plantable land and 2,500 acres of cultivable land, the latter to provide for additional forest workers' holdings. Planting operations, which covered 24,721 acres in the year ending with September, 1930, were to have been "stepped up" to 44,000 acres a year by 1938. It is anticipated that under the new program afforestation will be restricted to 20,000 acres per year and to land already acquired.

On the basis of calculations made by the forestry commission the select committee on estimates reported in 1929 that about three-fifths of the commission's expenditure might in certain circumstances be expected to yield a net return of as much as 3.7 per cent, but that the remaining two-fifths would yield a small return or none. Spread over the whole operation, the returns would average from 2 to 2½ per cent. The committee that formulated the Government's economy program held that as an investment of the national resources an estimated return of from 2 to 2½ per cent "has no attractions." As against the prospect of higher prices for timber "in the remote future" it urged the probability of the development of substitutes for timber and of forestry development in lands where it can be carried out more cheaply than in Great Britain. Considering afforestation as a means of settling the unemployed on the land, the committee stated that to find full-time work for one man in this way costs £140 per annum and that the capital cost of providing a forest worker's holding whereon a man can find part-time employment to supplement his work in the forest is estimated at from £400 to £600.

The minority of the committee reported in part as follows:

This is particularly one of those forms of development which must necessarily be done by the State if serious attention is to be given to it at all. Its value can not be judged from a purely commercial standpoint, and the commissioners have ample justification for the attitude they have adopted toward their functions when they state that "the object of afforestation is not to provide a remunerative investment for State funds but to meet certain deficiencies in the economic organization of the country which otherwise would not be made good."

It was represented to the committee that one of the considerations in mind when the present scheme was started was the bulky nature of timber as an import and its consequent heavy demands on tonnage. As a factor to be taken into account in the event of war, the necessity to import timber would be a serious consideration * * *.

Another important feature is that excessive forest depletion is at present going on in most parts of the world without adequate replacement by new planting * * *. In Great Britain, with the break-up of estates, woods are being felled and not replanted. That process is likely to be accelerated and the work of the commission remained as one of the few efforts to reconstitute rural Britain.

The commission are obtaining land on favorable terms and they do not anticipate that there is any prospect of a further fall in value * * *.

* * * The recommendations in the main report would, it appears, involve the gradual abandonment of any considered forest policy * * *. It must not be overlooked that this country imports timber products to a value of between £40,000,000 and £50,000,000 per annum, a large amount of which is finished material.

Sir Roy Robinson, the technical commissioner of the forestry commission, has stated that despite the curtailment of the program he will be able to maintain the integrity of his personnel and the continuity of the research work.

Corsican Pine Thrives on Poor Soils in Belgium

Corsican pine is giving promising results in Belgium, where it was introduced 40 years ago, writes Egide Rosseels in the Bulletin de la Société Centrale Forestière de Belgique. It accommodates itself to poor soils formerly devoted solely to Scotch pine, and grows well on such soils. In the forest of Couckelaere some Corsican pines were planted on sandy soil in 1882. At the age of 47 years, when they numbered 224 to the hectare, these trees had a volume of 335 cubic meters per hectare. This corresponds to an average annual growth of more than 7 cubic meters, aside from the thinnings made in the meanwhile. The circumferences of the trees at a height of 1½ meters varied from 75 to 190 centimeters. The heights varied from 16 to 20 meters.

On private property in Holland near the Belgian frontier there are several stands of Corsican pine of which the oldest, aged 40 years, has a volume of 440 cubic meters per hectare.

This species has an incontestable advantage over Scotch pine in the eyes of Belgian timber growers, observes M. Rosseels, in that its stem is absolutely straight. This is of special importance because in sales of timber for use in mines every curvature of the stem, however unpronounced, lowers the returns.

Corsican pine can not usually be grown in Belgium at elevations greater than 300 meters.

Progress of Elm Disease in Great Britain

A fourth annual survey to determine the spread of the Dutch elm disease in Great Britain disclosed in the fall of 1931 that the disease had attacked trees in Monmouth, Huntingdon, and Lincoln. With these additions, the counties in which the disease has been discovered now number 33. The disease has not been discovered anywhere in Scotland, and the area known to be infected in Wales is very small. In both those countries elms are relatively scarce and are separated by wide tracts of moorland. The districts most severely infected are Essex and the eastern part of Suffolk. This suggests to the forestry commission that the disease is favored by a climate drier than that of other parts of England.

The forestry commission is quoted as stating that "there is nothing to justify the fear that within some measureable space of time all our elms are going to be killed," and mentioning evidence that outside the districts where the disease is epidemic occasional trees recover. The commission has thought best not to go to the expense of undertaking any research on the disease, since intensive studies are in progress in Holland, France, and Germany.

Great Britain Trains Forest Apprentices

By Arthur C. Ringland, United States Foreign Agricultural Service

The British Forestry Commission maintains two schools for the training of forest apprentices—one at the Forest of Dean, for England and Wales, and one at Benmore Forest, for Scotland. Both schools are ideally situated and well housed, and have every facility for training in theory and practice and for demonstration and experimental work.

The Benmore school is located within a forest area of 11,000 acres in the rugged highlands of Argyllshire that was donated to the forestry commission in 1925. Formerly used for pasturing sheep, since 1870 the area has undergone successful afforestation. Some of the plantations now have almost the appearance of natural forest, particularly the Sitka spruce and the Douglas fir. The approach to the school building, formerly a manor house in the baronial style, is through a magnificent avenue of sequoias now reaching a height of more than 100 feet and having diameters of perhaps 40 inches.

The Forest of Dean is a 19,000-acre tract of Crown property of which 16,000 acres is wooded and under forest management and the remainder consists in open grazing ground subject to common rights. This is one of the more extensive remnants of the forests that once covered the greater part of Great Britain. In the days of the Normans it was a royal hunting forest. Here the forestry commission now has under intensive management stands of oak planted 100 to 120 years ago but badly neglected until 1896, when for the first time the forest was put under a sort of working plan. These stands, supplemented by extensive plantings of both hardwoods and conifers recently established by the commission and by four series of experimental plantations under the direction of the chief research officer, afford unusual opportunities to the students of the Dean school.

In each of the schools the course of training embraces theory and practice and covers a period of two years with but a short vacation. First-year work includes surveying; leveling; field and office mensuration; botany; pathology; nursery work; entomology; identification of trees, grasses, and seeds; and forest work including clearing, planting, fencing, draining, aftercare of plantations, etc. Second-year subjects include geology, meteorology, nursery work, silviculture, natural regeneration, thinning, mensuration, forest protection, utilization of timber, forest management, etc.

Appointments to the schools are eagerly sought. At Benmore, with an enrollment of 24, approximately 12 appointments are available each year. At Dean the enrollment this year is 37. Applicants must be between the ages of 19 and 25. Selection is based on previous experience in practical forestry work and on the outcome of written and oral examinations designed to determine educational preparation and personal fitness. A medical certificate of physical soundness is demanded.

There is no charge for this training. Apprentices are provided with free board, lodging, fuel, and light, and a money allowance of 10 shillings per week throughout the course. At the end of the first year a bonus at the rate of 2 shillings per week is paid to apprentices whose progress and conduct have been satisfactory and who undertake to attend the prescribed course for the second year. At the end of the second year a bonus at the rate of 3 shillings per week is paid if conduct and progress have continued to be satisfactory. While attending school the apprentices are required to wear uniforms.

Examinations are given periodically. Students who pass their examinations satisfactorily receive certificates of graduation.

While the forestry commission does not guarantee employment upon completion of the course, most of the men are recruited into the civil service. For one year they have charge of working crews and are known as "gangers." Men who prove capable may then be promoted to positions as foremen, and after three years are eligible to be rated "foresters second grade." They may progress to the highest positions in the forestry organization.

A wood specimen found in Norway in which compression wood was arranged in a spiral of at least three laps led E. Mork to the theory that compression wood, instead of resulting from compression on the under side of leaning branches and stems, is itself the cause of the leaning—a formation "which arises to bring the plant organism into balance with the geotropic force." This theory was presented under the title "Om Tennar" in Bilag til Tidsskrift for Skogbruk, 9 (1928).

Personals

Inman F. Eldredge is reentering the United States Forest Service as regional director of the Forest Survey in the South, after six years as manager of the 200,000-acre privately owned Suwannee Forest, at Fargo, Ga. During the first half of his 16-year connection with the Forest Service, beginning in 1909, Mr. Eldredge was supervisor of the Choctawhatchee and Ocala National Forests, in Florida. Later he was an inspector in the Branch of Forest Management of the Washington, D. C., office of the service. As regional director of the Forest Survey he will have headquarters at New Orleans.

Donald Bruce has left the Division of Silvics, United States Forest Service, to devote his entire time to work of the consulting forestry firm Mason & Stevens. Mr. Bruce previously resigned from the Forest Service, as supervisor of the Flathead National Forest, Mont., in 1915, to join the forestry faculty of the University of California. He left the university to return to the Forest Service in 1924. For several years he has divided his time between the Forest Service and Mason & Stevens.

Ellwood Wilson, forester for the Laurentide Paper Co., Quebec, has been appointed professor of silviculture at Cornell University as successor to Samuel N. Spring, newly appointed assistant dean of the New York State College of Forestry. Mr. Wilson has been manager of the forestry division of the Laurentide Co. since 1905. He was educated in the United States and in Europe and has had forestry experience in the States.

I. T. Bode has resigned as extension forester of Iowa to become secretary to the Iowa Fish and Game Commission. He is succeeded by Sylvan Runkel, a 1930 graduate of the Iowa State College.

James M. Mallory, for several years industrial agent of the Central of Georgia Railway, has been appointed to the Georgia Commission of Forestry and Geological Development to serve for a period of six years.

Lester H. Reineke has been transferred from the California Forest Experiment Station to the Northeastern Forest Experiment Station, as a silviculturist specializing in mensuration. Mr. Reineke has completed the requirements for the M. F. degree from the University of California.

Donald N. Matthews, who has had charge of Forest Survey activities on the national forests of the North Pacific Region, will soon conclude that work and will then transfer to the Pacific Northwest Forest Experiment Station to assist Richard E. McArdle in fire research. Mr. Matthews was formerly assistant supervisor of the Umpqua National Forest, Oreg.

Ralph S. Hosmer, head of the forestry department of Cornell University, has been elected a fellow of the Society of American Foresters. Professor Hosmer is the thirteenth member of the society to receive this honor.

Members recently appointed by the Secretary of Agriculture to the forest research advisory councils of four forest regions are as follows: Allegheny—Ezra B. Whitman, engineer, Baltimore, Md.; Lewis E. Staley, secretary, Pennsylvania Department of Forests and Waters; and E. S. Cary, manager, Pocono Lake Preserve, Moorestown, N. J.: Pacific Northwest—Ossian Anderson, president, Puget Sound Pulp & Timber Co., Everett, Wash.; N. C. Jamison, manager, Sauk River Timber Co., Everett, Wash.; John Woods, forester, Long-Bell Lumber Co., Longview, Wash.; and Paul Neils, manager, Mount Adams Pine Co., Portland, Oreg.: Central States—Alexander W. Thomson, president, Champion Coated Paper Co., Hamilton, Ohio: Appalachian—B. L. Roberts, forester, Cherry River Boom & Lumber Co., Richwood, W. Va.; and T. G. Woolford, Retail Credit Co., Atlanta, Ga.

W. J. Keays, formerly engineer with the War Department, has been appointed associate forest engineer in the Forestry Branch of the Indian Service and assigned to highway construction.

Frederick Erskine Bronson, president and managing director of the Bronson Co., Ottawa, is president of the Canadian Forestry Association for 1932. Robson Black is vice president.

Frank B. Lenzie has been appointed range supervisor in the Forestry Branch of the Indian Service, United States Department of the Interior. Mr. Lenzie resigned seven years ago from the United States Forest Service, leaving a range management position in the North Pacific Region.

E. G. Wiesehuegel, assistant professor of forestry in Ohio State University, is president of the Ohio Forestry Association for the present year. F. W. Dean, extension forester, is secretary-treasurer. Willis M. Baker, director of the Central States Forest Experiment Station, has been made a member of the executive council.

W. C. Bramble, a 1929 forestry graduate of the Pennsylvania State College who has done graduate work in forest pathology at Yale, has been awarded a National Research fellowship in forestry, for study in the United States.

L. T. Pierce, of the United States Weather Bureau, is now stationed at Asheville, N. C., as a forest fire weather forecaster. The region which he will serve includes southern Virginia, eastern Tennessee, western North Carolina, and northern Georgia.

Bibliography

Old-Growth Forests of Southeastern Europe

By Paul W. Stickel, United States Forest Service

In his volume Aufbau, Wuchs und Verjüngung der Südosteuropäischen Urwälder,[6] Karl M. Müller has presented conclusions regarding the silviculture of the primeval forests of Bulgaria that should be of interest to all American foresters interested in the succession of types in virgin forests and concerned with the problem of bringing about natural regeneration of pure coniferous stands. This excellent publication should have a particular appeal to western foresters because of the similarity in floristic and ecological conditions between southern Bulgaria and the western United States. It is a European counterpart of the pyroecological studies of Clements (*1*) and Show and Kotok (*2*) in the United States. Müller's studies have indicated that in the pine forests of southeastern Europe fire has an unquestionable place as a legitimate silvicultural agent.

The investigations reported in this volume have to do with the forest vegetation of the Rhodope, Prin, and Rilo Mountains, in south-central and southeastern Bulgaria. The topography of these Bulgarian highlands is rugged and steep; the Rilo Range has 12 peaks with elevations of 9,000 feet or more, of which the tallest—Mus Allah—reaches 9,589 feet. Being of volcanic origin, the rocks are formed largely of gneisses, crystalline schists, and granite. Although Bulgaria is essentially a semiarid region its mountains have an annual precipitation of between 25 and 40 inches (varying according to altitude), which is sufficient to maintain several large rivers such as the Struma, Mesta, and Marista. Southern Bulgaria can be characterized as a typical dry-autumn region, less than 20 per cent of the annual rainfall occurring during the autumn months. Spring is the period of greatest rainfall, with more than 30 per cent. High maximum temperatures occur during the period of minimum precipitation.

As in other mountain regions, the forest types follow distinct altitudinal zonations. The distribution of the forest vegetation of the Rhodope Mountains may be used as a criterion for the entire region. In the Rhodope Mountains six distinct types occur:

1. Oak scrub type, restricted to the foothills at elevations of 1,600 to 2,600 feet. Forms a typical brush forest caused primarily by repeated fires and overgrazing. The principal tree species are the European Turkey oak (*Quercus cerris*), durmast oak (*Q. sessiliflora*), and pubescent oak (*Q. lanuginosa*, syn. *Q. pubescens*).

2. Austrian pine (*Pinus nigra*) type, found between 2,600 and 3,900 feet. Not so much the product of altitudinal influences as of variations in geological formations. Austrian pine is confined to small isolated lime formations upon which it forms pure stands.

3. European beech (*Fagus sylvatica*) type, confined to the lower slopes of the mountains at elevations of 3,900 to 5,000 feet. In general the trees have such poor form that the stands have all the characteristics of a coppice forest.

4. Scotch pine (*P. sylvestris*) type, found at altitudes of 5,000 to 5,600 feet. Occurs generally in pure stands. Where soil moisture conditions are more propitious, however, Norway spruce (*Picea abies*, syn. *P. excelsa*) is admixed with the pine. Beech is missing from these pine stands because of adverse site conditions.

5. Norway spruce type, extending from the upper edge of the Scotch pine type (5,600 feet) to 6,200 feet. Mainly pure except in dense stands on moist sites, where European silver fir (*Abies alba*, syn. *A. pectinata*) is found associated with spruce.

6. Subalpine mixed type. Above 6,200 feet the dense closure of the Norway spruce type is lost, and the stands have a parklike appearance typical of high-mountain forests. The spruces are open grown with poor stem form. Above 6,600 feet the mountain juniper (*Juniperus communis montana*, syn. *J. nana*) forms a typical alpine brush type with scattered, weather-beaten spruces. The type extends to about 6,900 feet.

7. The following species are found up to about 5,900 feet, but do not form distinct permanent types: European aspen (*Populus tremula*), European white birch (*Betula alba*, syn. *B. pubescens*), and gray willow (*Salix cinerea*).

In the Prin region occur four pine types, two calcareous and two noncalcareous. In addition to an Austrian pine type found between 3,000 and 3,900 feet there is a graybark pine (*P. leucodermis*) type existing as small pure stands on soils rich in lime at elevations of from 5,000 to 6,600 feet. The noncalcareous pine types, Macedonian pine (*P. peuce*) and mugho pine (*P. montana mughus*), are found at altitudes of 5,200 to 6,200 feet and 6,600 to 7,300 feet, respectively. Furthermore the Norway spruce type occurs at much lower elevations than in the Rhodope Mountains, being found at 3,900 to 5,000 feet.

Except for the occurrence of the Norway spruce-European silver fir type at 5,000 to 5,900 feet and of the Macedonian pine and mountain pine types at 5,600 to 6,600 feet and 6,600 to 7,300 feet, respectively, the floristic composition and zonal distribution of types in the Rilo Mountains are similar to those listed for the Rhodope area.

Although these Bulgarian mountain forests are not old as compared with the virgin forests of the western United States, a 250-year age class being the oldest cited by Müller, they are essentially primeval woodlands because the stands have never been subjected to commercial exploitation. These forests are still the natural home of a nomadic primitive people whose

[6] Aufbau, Wuchs und Verjüngung der Südosteuropäischen Urwälder: Eine waldbauliche Studie über den Urwald unserer Zone überhaupt. (Composition, growth, and regeneration of the primeval forests of southeastern Europe: A silvicultural study of the primeval forest of our zone.) 323 pp. M. & H. Schaper, Hannover, 1929.

principal occupations are hunting, fishing, and grazing. While the utilization demands of these forest inhabitants have produced no marked changes in the natural vegetation, their activities have had a very pronounced influence. Fires set by the herders for improving pasture facilities, as well as fires set by lightning and fires formerly set by the Turks for strategic purposes, have led to a regular succession of species through changes in seed-bed conditions. Fire is the principal dynamic factor causing an alteration of composition in the Bulgarian forests.

For the purpose of outlining the succession Müller has listed the major tree species in three ecological groups: Light-demanding trees, half-shade trees, and full-shade trees. Scotch and mugho pines and aspen are essentially light-demanding species. To the group of half-shade species belong such trees as the Austrian, graybark, and Macedonian pines. Full-shade species are represented by beech and Norway spruce. Müller summarizes the optimum climatic and edaphic conditions for these three groups as follows:

	Light-demanding species	Half-shade species	Full-shade species
Climatic optimum	Arid	Transition	Humid.
Edaphic optimum (seed bed).	Mineral and burned-over soil.	do	Duff and humus

Wind and fire are the only major catastrophies that initiate on a broad scale the cycle of succession in these primeval woodlands. Save where special site factors are operative, such as high lime content in the soil, there is a normal cycle from light-demanding species through half-shade to full-shade species. For example, after fire sweeps through a climax full-shade stand of Norway spruce the bare mineral soil is quickly seeded by Scotch pine, for which the site is now optimum. If fire does not revisit the area until the cycle is complete the pure pine stand, by creating less xerophytic site conditions, slowly prepares the way for its own replacement. Particularly do the pines improve edaphic conditions by the formation of a humus soil cover. In time spruces gradually invade the pure pine stand, so that for a while a mixed forest of pine and spruce exists. Imperceptibly but surely, as conditions become more mesophytic and the humus layer is built up, the pines are crowded out by the spruces until once again there results a pure spruce forest, the climax type. Where pine is absent from burned-over spruce stands the burn is invaded first by aspen, willow, and birch, which form the initial stands. These species are then gradually replaced by spruce, in much the same way as pine is crowded out by spruce in the succession just described. Succession after windfall is very similar to that following fire. On a windfall area, however, pine does not form such dense pure stands, because widespread bare mineral soil is not present. Since the humus cover is not destroyed on blow-down areas, the interval from initial succession to the establishment of the climax type is materially reduced.

Müller's contention that pure, even-aged primeval forests are the manifestations of previous catastrophies—particularly fire— is well substantiated by stand conditions in the pine and spruce types as described. The outstanding characteristic of the Scotch pine type, uniformity as to both age and purity, is in fact due wholly to the occurrence of fire. Going one step further, it may be said that the pines owe their perpetuity in no small degree to the frequent recurrence of fire. Were it possible to exclude fire completely from these pine stands, the entire type in time would be taken over by spruce at its upper altitudinal zone and by beech at the lower limits. Similar instances may be cited of the elimination of a dominant species during succession in primeval forests in the United States; for example, the exclusion of Douglas fir by western red cedar and western hemlock in the Pacific Northwest region (*3*) and of lodgepole pine by Engelmann spruce, Alpine fir, and ponderosa pine in the central Rocky Mountains (*1*).

It is in the pine types, especially Scotch and mugho pines, that the effects of fire are most apparent. Throughout these types evidences of surface, ground, and crown fires occur everywhere. That fire is a comparatively frequent phenomenon in the pine forests is evidenced by the preponderance of young age classes (1 to 40 years). It is by no means uncommon to find such young, pure, even-aged pine stands covering an area of several hundred hectares. Crown fires sweeping through pure pine or mixed pine-spruce stands kill most of the trees except for scattered individuals left standing usually along the upper slopes or on top of the ridges. The fire-killed pines generally fall a year or so after the fire, while the dead spruces remain standing for a much longer time. On the whole, the burned areas are comparatively free from snags. Where pine seed trees exist the bare mineral soil is covered almost directly after the fire by a dense stand of pine seedlings. The Scotch pine of the Bulgarian region is a much more prolific seeder than that of north-central Europe. Likewise its seed are lighter, so that they are carried much farther by the wind. Furthermore, in contrast to the seed-bed conditions found in the managed forests of north-central Europe, where fire is rigidly excluded, in wild, fire-swept Bulgarian forests the exposed mineral soil and layer of ashes favor the germination and early development of the pine seedlings. Natural reproduction is, therefore, assured, a fact that is in direct contrast with the uncertain natural reproduction of this species in Germany. Finally, the growth of the pine seedlings is favored by the fact that repeated surface fires have excluded the establishment of any competing heather vegetation.

Surprisingly, the young natural pine stands arising on burned-over areas have an appearance closely resembling that of managed stands on which such cultural operations as weedings and thinnings have been

carried out. The initial dense forests are thinned out by subsequent surface and ground fires. The trees have tall, straight boles with little taper. Because of the "fire weeding and pruning" the trees have a comparatively high percentage of clear length, even when they are immature. Growth, however, is slow, and the sapwood thin. As a rule there is little vegetative cover on the ground; raw humus and moss are conspicuous by their absence. It is not until the pine stands lose their purity through the invasion of spruce that a real humus cover is finally established. With such extensive pure even-aged stands present one would naturally assume that insects and fungi must assume considerable importance, but this is not the case. Müller assumes that the nonexistence of insect or fungal epidemics is due largely to the fact that surface and ground fires keep these enemies in check by burning away the undergrowth and litter cover. Thus, exclusive of its killing action, fire has a three-fold effect on the pine types: it creates optimum seed-bed conditions and furthers the early growth of pine seedlings by removing competing surface vegetation; it weeds and prunes the resultant stands; and, finally, it reduces the danger of insect and fungal epidemics.

As has already been indicated, Norway spruce and European silver fir can not establish themselves on bare, burned-over mineral soil or soil covered with ashes, even if excellent seed trees of these species are in a position to scatter their seed over the area. These two species require a humus soil cover in which considerable moisture is available. As a rule the spruce stands are considerably older than the pine stands. When once a spruce forest has usurped an area formerly occupied by pine, the shade-enduring species of the spruce type, with their long-persisting, low branches so successfully conserve the soil moisture that fires are less likely to occur. This is particularly true before the spruce stands become overmature. Since the invasion by spruce and fir covers a considerable period of time, the mixed spruce stands are less uniform in age than the pine. As the mixed type reverts more and more to a pure spruce or mixed spruce-fir type, the unevenness in age increases. With advance in age there is a corresponding increase in the formation of raw humus acid soil, accompanied by a more or less dense ground cover of moss and other vegetation. Natural reproduction becomes increasingly difficult, so that the very old spruce stands are rather open, with trees of comparatively short height and poor form. When fire does occur in such old stands it is extremely destructive, crowning easily because of the low branches. One interesting evidence of grazing damage to young spruce seedlings is the presence of "nest-grown" spruces. This formation consists of the growth of two or more stems from a common base, giving the appearance of sprout growth rather than of seedling origin.

Pure, even-aged stands of aspen and birch have an even less permanent character than those of Scotch and mugho pine. Aspen stands more than 40 years of age occur infrequently. The dense, pure, even-aged stands of this species which arise on freshly burned over soil usually succumb to a fungus before the trees reach 20 years of age. Although aspen is very sensitive to fire injury, where fire does not burn deeply enough into the soil to kill the roots the species sprouts prolifically, so that in the second generation there is a much greater percentage of sprout-origin than of seedling-origin stock. Because of its ability to withstand shade, spruce is able to form an understory under aspen, eventually crowding it out. When aspen and pine seed an area simultaneously, the latter species does not successfully establish itself unless the former is early thinned out by disease or fire. What has been stated regarding the development of aspen stands applies equally to birch stands, except that birch is not subject to any particular disease and therefore reaches a more mature age before being crowded out by spruce and fir.

Müller's study of succession in the primeval woodlands of the Bulgarian mountainous regions is an important and interesting contribution to our knowledge of this phase of forest development. To me it seems that Müller's conclusions logically induce the question Has fire a legitimate place in North American silvicultural practice? In Newfoundland, at least, Gilmore (*4*) has found that spruce growth is better on old burns than in virgin stands on areas where no fire has occurred for a long time. Such an eminent forest soil specialist as Hesselman (*5*) states that in Sweden, where conditions in general are similar to those in the northeastern United States, "forest fires have often, if not always, favored reproduction. Stands started on burned soils often show an astonishingly vigorous growth, which appears the more noteworthy when compared to the weak growth of stands on soils long protected from fire but otherwise—geologically and physically—similar." In the southern Appalachian Mountains, magnificent even-aged pure stands of yellow poplar sometimes occur on areas that differ from adjacent areas supporting less valuable stands only by the fact that they were burned over prior to restocking (*6*). Lastly, in New England there is a forestry axiom that "pine does not follow pine." According to Fisher (*7*) many of the pure, second-growth pine stands in New England exist on land once used for pasture and tillage, in other words on soil that, prior to the invasion by pine, was bare or had very little humus cover. May it not be that the judicious use of fire just previous to the harvesting of the pine crop trees (in the early spring when the soil is still frozen but when a surface fire will consume much of the raw-humus pine litter) will prove a necessary silvicultural measure to insure the natural regeneration of this pure pine type, and will be followed quickly by the establishment of a highly valuable stand instead of the poor-quality mixed brushy stand which so often follows the clear-cutting of pine?

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A New Method of Applying Yield Tables

By C. Edward Behre, United States Forest Service

As a result of unsatisfactory experience in applying normal yield tables in the usual way, i. e., by assuming that future yields will approximate those given in the yield table in the same ratio in which present basal area approximates the corresponding yield-table figure, G. H. Barnes suggests [7] basing all yield prediction for even-aged stands on the average diameter of the stand. He shows that this simple procedure gives results much closer to actual experience in dealing with the lodgepole pine stands of the Yahk Forest in British Columbia.

The weakness of the conventional method of predicting yields on the basis of site and age by applying the basal area ratios is especially serious when merchantable volumes are sought rather than total yield in cubic feet.

The method presented by Barnes consists of the following steps:

1. Estimate future average diameter from an anamorphic chart based on a curve of average stand diameter over age which can be conveniently presented as an alinement chart.

2. Use this estimated average diameter to obtain the future number of trees per acre from a curve of number of trees per acre over average diameter.

3. Use the estimated average diameter again to obtain the future average height of the stand from a curve of average height over average diameter of stand. In this step it is assumed that the stand will maintain in the future the present ratio between actual height and the curved height corresponding to its average diameter.

4. Apply these figures to charts showing the volume per 100 trees according to average height and average diameter of the stand. These volume charts may be prepared on any basis desired such as total cubic content or merchantable volume in board feet.

[7] Barnes, G. H.: The importance of Average Stand Diameter as a Factor in Forecasting Timber Yields. 24 pp., including 6 tables and 9 charts. British Columbia Department of Lands, Forest Service. 1931.

In order to prepare the volume charts used in this method it is necessary (1) to employ stand tables based on average diameter to distribute the estimated number of trees among the diameter classes, and (2) to have a basis for assigning an average height to each diameter class. With this information volume tables can be applied to the data at hand. For convenience of application the total volumes are reduced to the basis of volume per 100 trees according to average height and diameter of the stand. The assignment of an average height to each diameter class in the stand table is accomplished by sorting the basic plot data according to average diameter and expressing the average height of each diameter class as a percentage of the height of the average diameter class. These values are then harmonized graphically.

By developing this modification of yield prediction methods Barnes has made an important contribution to a much-debated question. Average diameter and number of trees per acre constitute one mode of expressing the distribution of the trees among the size classes, which is obviously the primary factor in determining the yield according to any standard of utilization. It is probable that future advances in forest mensuration will develop from further studies of the characteristics of the stand tables.

Seeding Tests With New Mexico Forage Plants

By R. R. Hill, United States Forest Service

Under the title "The Artificial Reseeding of New Mexico Ranges," [8] C. P. Wilson has reported on experiments carried out by the New Mexico Agricultural Experiment Station in various parts of the State with seed of many forage plants. His account is clear and complete, and is well illustrated. The results of the experiments are conclusive in regard to the germination of seed of the different plants tested, and indicate in a general way the extent to which a number of the species may be expected to become established in small plots from which competing growth has been largely eliminated. They are not at all conclusive, however, as to the extent to which most of the species considered may be expected to become established under actual range conditions.

In general, the problem of range revegetation is concerned chiefly with increasing a stand of vegetation already established and encouraging the ascendency of the more desirable plants of the association. Most of the species included in these tests are native to New Mexico and are already established to a greater or less degree over large areas of range land in the State. Presumably they already have the opportunity to develop seed and their seed has opportunity to germinate. This process has been going on, through favorable and unfavorable seasons, over an indefinite period of time. The question arises as to whether artificial reseeding with native species will be any more suc-

[8] Bulletin No. 189, New Mexico Agricultural Experiment Station.

cessful over a period of years than the natural reseeding of the same species. If artificial reseeding is to be any more successful than natural reseeding has been it would seem necessary to establish more favorable conditions, as by preparing a seed bed, removing competing plants, restricting grazing, and eliminating rodents. Mr. Wilson does not indicate what measures of this kind would be necessary to the success of artificial revegetation. Neither does he consider whether if natural reproduction were assisted by such measures satisfactory revegetation would result.

There is little question that under certain conditions, such as on abandoned farms with tillable soil and on denuded flats where the soil is deep and moist, artificial reseeding would be more successful and more economical than any other method of increasing the forage stand; but for the greater part of the New Mexico ranges, where the original composition of the vegetative cover has not been radically modified and where conditions for rapid revegetation are unfavorable, both the practicability and the need of artificial reseeding are questionable. Only when these phases of the question have been thoroughly covered in a reseeding experiment can information be made available to the landowner that will safely guide him in determining whether he should resort to artificial reseeding and if so when and where he should practice it.

The germination-test data tabulated are valuable for reference and as a guide in selecting plants for artificial reseeding. Additional information regarding the soil, rainfall, and other conditions that are favorable to the establishment of individual forage species would add greatly to the usability of these data.

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